# Human Life on Mars?

Samantha T. Bennett, Scott Buck, Valeria Crnjanski, Jason D'Souza
Jacob Kimball, Connor Leek, Elizabeth Moon, and Antonio Palinkas
*Faculty Advisor*: J.N. Jensen

## HYPOTHESIS

Given the current level of development in the scientific fields of health, engineering, biology and the social sciences, it is possible for humans to travel to and inhabit Mars.

## INTRODUCTION

This poster will explore whether we have the knowledge and resources to colonize and survive the barren Martian wasteland. We will present the technology necessary to travel to Mars and back safely and efficiently. We will examine the problems that low gravity and radiation may cause in the human body and present solutions. The poster will present the challenges for a self-sufficient living environment for humans on the surface of Mars. It will also assess potential societal structures of a Martian colony and whether or not we as a species are ready to explore Mars to begin with.

## TRANSPORTATION

NASA is currently developing a spacecraft, *Orion Multi-Purpose Crew Vehicle* (MPCV, Figure 1), which will be capable of making it beyond low Earth orbit (LEO). Through increasingly challenging missions, NASA plans to use *Orion* to travel to Mars. In 2014, *Orion* will undergo an orbital flight test. It will be launched more than 3,600 miles into space unmanned. For more information about *Orion*, visit NASA's website www.nasa.gov.

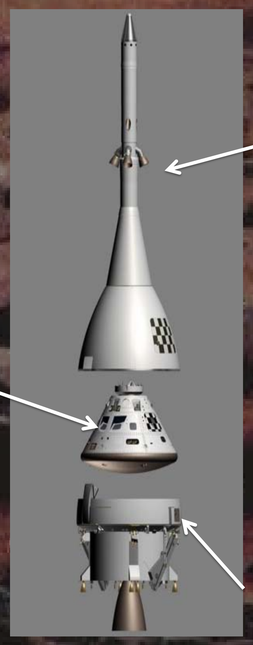


**Figure 1: Orion**
(Source: www.fastcompany.com/1755194/meet-the-space-shuttle-successor-innovation-from-history)

## SOCIAL

### Attitudes about Space Travel

UB students were surveyed about their attitudes concerning space travel and otherworld colonization. The survey results are shown in Figure 2. Note that students are much more willing to train as an astronaut, go into space, and live on the Moon than they are to live on Mars.

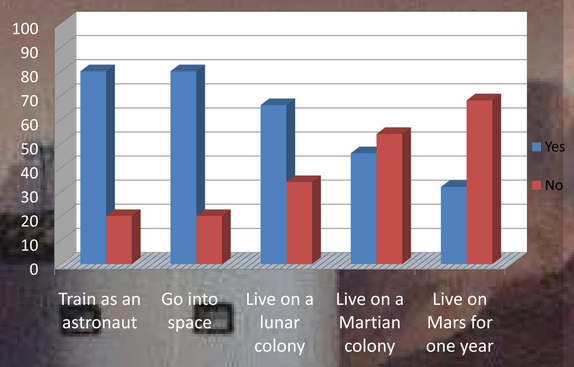


**Figure 2: Willingness of UB Students Regarding Space Exploration**
(blue = "yes," red = "no")

### Social Aspects and Martian Colonial Government

Qualities

An analogy can be established between colonization during the age of imperialism and the colonization of Mars. The distance from Earth to Mars is between 58 and 400 million km. It will be 1.6 years until the two planets are close enough for resupply. Adaptation for disease, famine, and technological malfunction is mandatory, so the colony should be able to function without all members.

The Government

Colony resilience requires that each colonist will be in charge of a certain field with cross-training between fields. As seen with the Biosphere 2 project (see Biome section), long-term isolation can lead to interpersonal conflict, a breakdown of society, and finger-pointing. It is proposed that fewer conflicts will occur if a hierarchy in expertise is employed.

In an environment where split decisions are needed, democracies may be too slow. It is recommended that the leader be empowered power through a constitutional aristocracy.

## BIOMES

### Space Travel

We used the *Mars-500* experiment as a model for human travel to Mars. The Mars-500 experiment was conducted at the Russian Academy of Sciences' Institute of Biomedical Problems in Moscow to simulate the travel from Earth to Mars. The 520-day experiment ended on November 4, 2011. While data is still being analyzed, it appears that psychosocial pressures from the 17-month isolation were tolerable.

### Mars Colony

We used the experiment *Biosphere 2* (a self sustainable environment set up in Arizona) as a model for a human habitat on Mars. Biosphere 2 experiment operated continuously for two years (1991-1993) as a completely self-sustained ecosystem (see Figure 3). However, the mission was stopped because of low oxygen levels. The low oxygen levels were thought to be due to respiration from soil microorganisms. In addition, psychosocial problems (including the formation of factions) were observed (see Social section).

The Biosphere 2 experience suggests that a short-term colony on Mars may be possible. Significant challenges exist regarding the costs of transporting materials to Mars to simulate Biosphere 2. Further research is needed on the geology and biology of Mars. A joint NASA/European Space Agency (ESA) program is planning trips to send a rover to Mars to collect samples and return them to Earth. The samples are necessary for determining materials needed for the establishment of a Martian colony.

**Figure 3: Biosphere 2**
(Source: vulgare.net/biosphere-2)

## HEALTH

### NASA's Biocapsule

The biocapsule is a device developed by NASA for the delivery of drugs and cells. It releases drug/treatments slowly over time as the body needs it. In theory, it can release treatments for exposure to radiation into the bloodstream slowly over time. Those drugs include potassium iodide (KI) and glutathione (GSH). Both drugs are currently used on Earth to treat people that have been exposed to radiation. KI only prevents the thyroid from exposure and GSH detoxifies the body to prevent cancers. Scientists are also examining the use of sea vegetables salts, which contain substances that bind to radioactive particles and allows the body to remove them.

The biocapsule is the size of a pencil tip. It can be implanted under the skin, most likely in the thigh. Biocapsules are made of carbon nanotubes.

Dealing with zero-gravity is also an issue for astronauts. Anabolic steroids and insulin-like growth factor-1 (IGF-1) therapy can be used to prevent muscle-loss in the areas of the body that would normally be used for walking (e.g. the legs and hips). High protein/calcium diets are also useful in preventing muscle and bone-loss, but not completely. Exercise using elastic bands helps to strengthen the muscles, but results in poor hygiene. The astronauts have to use chamois cloths to bathe and shower.

## DISCUSSION

Human exploration of space is possible. However, the specific goal of getting humans to explore and colonize Mars is not yet attainable. Challenges include:

- Health threats
  The constant threat of radiation and problems that arise from being in zero-gravity exceed our current methods of treatment. Biocapsules may offer a treatment alternative in the future.
- Biome construction
  Martian biomes would take too much time and too many trips to finish.
- Public attitudes
  Our survey results suggest that the general public is not very excited about travel to Mars or about living there for an extended period of time.

SOURCES
www.allthetests.com/quiz26/quiz/1245775173/Would-You-Make-a-Good-Leader
www.thespacereview.com/article/305/1
mars.jpl.nasa.gov/programmissions/technology/
news.yahoo.com/nasa-biocapsule-could-change-practice-medicine-194000032.html
A. Nicogossian. Medicine and space exploration. *Lancet*, 362(1), s8-s9, 2003.
S.M. Smith and S.R. Zwart. Nutrition issues for space exploration. *Acta Astronautica,* 63(5-6), pp. 609-613, 2008.
www.migrelief.com/tag/how-to-treat-radiation-exposure
www.nasa.gov/exploration/systems/mpcv/index.html